

Appl. No. 10/607,611
Amdt. dated March 13, 2006
Reply to Office action of December 12, 2005

PATENT**IN THE CLAIMS**

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) An electroplating apparatus for electroplating a surface of a wafer, the surface of the wafer capable of being electrically charged as a cathode, comprising:

a proximity head capable of being electrically charged as an anode, the proximity head having a plurality of inputs and a plurality of outputs, and when the proximity head is placed close to the surface of the wafer, each of the plurality of inputs is capable of delivering a fluid to the surface of the wafer and each of the plurality of outputs is capable of removing the fluids from the surface of the wafer to define a controlled meniscus between the proximity head and the surface of the wafer, the delivery and removal of fluids to and from the surface of the wafer enabling a localized metallic plating when the wafer and proximity head are charged, and the localized metallic plating facilitated at a location of the controlled meniscus, and the controlled meniscus being capable of movement when either the proximity head or the wafer are moved.

2. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 1, wherein the wafer is electrically charged as the cathode by way of a contact to a negative bias power supply.

3. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 2, wherein the contact is made to an edge exclusion region of the wafer.

4. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 1, wherein the proximity head is electrically charged as the anode through electrical contact with a positive bias voltage supply.

Appl. No. 10/607,611
Amdt. dated March 13, 2006
Reply to Office action of December 12, 2005

PATENT

5. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 1, wherein each of the plurality of inputs on the proximity head are defined as one of circular conduits, annular rings, and discrete conduits.

6. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 1, wherein the fluid is defined by one or more fluids and the fluids are selected from the group comprised of isopropyl alcohol (IPA), electrolytic solution, a plating chemistry that enables metallic plating, and an abrasive-free reactive chemical.

7. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 6, wherein the plating chemistry is defined by an aqueous solution for depositing metals including one of a copper material, a nickel material, a thallium material, a tantalum material, a titanium material, a tungsten material, a cobalt material, an alloy material, and a composite metallic material.

8. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 1, wherein each of the plurality of outputs on the proximity head are defined as one of circular conduits, annular rings, and discrete conduits.

9. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 1, wherein the localized metallic plating, confines a volume of the fluid within an area beneath the proximity head, the area being less than an entirety of the wafer surface.

10. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 1, wherein an eddy current sensor enables monitoring of the localized metallic plating.

Appl. No. 10/607,611
Amdt. dated March 13, 2006
Reply to Office action of December 12, 2005

PATENT

11. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 1, wherein a polishing pad assists in leveling thickness variation below the proximity head.

12. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 11, wherein the abrasive-free reactive chemical supplied by the plurality of inputs is applied to the polishing pad.

13. (Original) An electroplating apparatus for electroplating a surface of a wafer, comprising:

a first proximity head configured to be placed over the surface of the wafer, a first fluid electrically charged as an anode for depositing a metallic layer over the surface of the wafer is capable of being generated between the proximity head and the surface of the wafer; and

a second proximity head configured to be placed over the surface of the wafer, a second fluid electrically charged as a cathode for enabling a non-consumable chemical reaction over the surface of the wafer is capable of being generated between the proximity head and the surface of the wafer, wherein an electrical connection is defined between the first fluid and the second fluid when depositing the metallic layer over the surface of the wafer.

14. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 13, wherein the first fluid provides electrical coupling to the substrate through electrolytic properties of the first fluid that is charged as the anode through electrical contact with a positive bias voltage supply.

15. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 13, wherein the second fluid provides electrical coupling to the substrate through electrolytic properties of the second fluid that is charged as the cathode through electrical contact with a negative bias voltage supply.

Appl. No. 10/607,611
Amdt. dated March 13, 2006
Reply to Office action of December 12, 2005

PATENT

16. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 13, wherein beneath the second proximity head a non-consumable chemical reaction prevents dissolution of the metallic layer by producing an offsetting reaction.

17. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 16, wherein the non-consumable chemical reaction is an offsetting reaction produced by a reduction of oxidation process.

18. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 13, wherein each of the plurality of inputs on the first proximity head and the second proximity head are defined as one of circular conduits, annular rings, and discrete conduits.

19. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 13, wherein each of the plurality of outputs on the first proximity head and the second proximity head are defined as one of circular conduits, annular rings, and discrete conduits.

20. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 13, wherein the fluid beneath the first proximity head is defined by one or more fluids and the fluids are selected from the group comprised of isopropyl alcohol (IPA), electrolytic solution, and a plating chemistry that enables metallic plating.

21. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 20, wherein the plating chemistry is defined by an aqueous solution for depositing metals including one of a copper material, a nickel material, a thallium material, a tantalum material, a titanium material, a tungsten material, a cobalt material, an alloy material, and a composite metallic material.

PATENT

Appl. No. 10/607,611
Amdt. dated March 13, 2006
Reply to Office action of December 12, 2005

22. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 13, wherein the fluid beneath the second proximity head is defined by one or more fluids and the fluids are selected from the group comprised of isopropyl alcohol (IPA), electrolytic solution, and water.

23. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 13, wherein the localized metallic plating confines a volume of the fluid within an area beneath the first proximity head, the area being less than an entirety of the wafer surface.

24. (Original) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 13, wherein an eddy current sensor enables monitoring of the localized metallic plating beneath the first proximity head.

25. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer, comprising:

a first proximity head configured to be placed over the surface of the wafer, a first fluid electrically charged as an anode for depositing a metallic layer over the surface of the wafer is capable of being generated between the proximity head and the surface of the wafer; and

a second proximity head configured to be placed over and in physical contact with the surface of the wafer, the second proximity head being in physical contact by way of a pad to enable removal of at least a portion of the metal layer, a second fluid electrically charged as a cathode for enabling a non-consumable chemical reaction over the surface of the wafer is capable of being generated between the proximity head and the surface of the wafer, wherein an electrical connection is defined between the first fluid and the second fluid when depositing the metallic layer over the surface of the wafer.

26. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, wherein the first fluid provides electrical coupling to the

Appl. No. 10/607,611
Amdt. dated March 13, 2006
Reply to Office action of December 12, 2005

PATENT

substrate through electrolytic properties of the first fluid that is charged as the anode through electrical contact with a positive bias voltage supply.

27. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, wherein the second fluid provides electrical coupling to the substrate through electrolytic properties of the second fluid that is charged as the cathode through electrical contact with a negative bias voltage supply.

28. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, wherein beneath the second proximity head the non-consumable chemical reaction prevents dissolution of the metallic layer by producing an offsetting reaction.

29. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 28, wherein the non-consumable chemical reaction is an offsetting reaction produced by a reduction of oxidation process.

30. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, wherein each of the plurality of inputs on the first proximity head and the second proximity head are defined as one of circular conduits, annular rings, and discrete conduits.

31. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, wherein each of the plurality of outputs on the first proximity head and the second proximity head are defined as one of circular conduits, annular rings, and discrete conduits.

32. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, wherein the fluid beneath the first proximity head is defined by one or more fluids and the fluids are selected from the group comprised of isopropyl alcohol (IPA), electrolytic solution, and a plating chemistry that enables metallic plating.

Attorney Docket No. LAM2P428

7

Appl. No. 10/607,611
Amdt. dated March 13, 2006
Reply to Office action of December 12, 2005

PATENT

33. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 32, wherein the plating chemistry is defined by an aqueous solution for depositing metals including one of a copper material, a nickel material, a thallium material, a tantalum material, a titanium material, a tungsten material, a cobalt material, an alloy material, and a composite metallic material.

34. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, wherein the fluid beneath the second proximity head is defined by one or more fluids and the fluids are selected from the group comprised of isopropyl alcohol (IPA), electrolytic solution, water, and an abrasive-free reactive chemical.

35. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, wherein the localized metallic plating, confines a volume of the fluid within an area beneath the first proximity head, the area being less than an entirety of the wafer surface.

36. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, further comprising,

an eddy current sensor to enable monitoring of the localized metallic plating beneath the first proximity head.

37. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, wherein the pad comprises a polishing pad for leveling thickness variation of the metallic layer below the second proximity head.

38. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 37, wherein an abrasive-free reactive chemical supplied by the plurality of inputs on the second proximity head is applied to the polishing pad.

Appl. No. 10/607,611
Amdt. dated March 13, 2006
Reply to Office action of December 12, 2005

PATENT

39. (Withdrawn) An electroplating apparatus for electroplating a surface of a wafer as recited in claim 25, further comprising,
a scatterometer system to control the leveling of thickness variation in the metallic layer beneath the second proximity head.